THEILER GEDENKLESING*

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Geagte Meneer die Dekaan, ek beskou dit as 'n besondere voorreg om deur lewering van die Theiler gedenklesing hulde te bring aan iemand wie se naam 'n legende geword het in veeartsenykunde in Suid-Afrika. Hy het as jong Switserse veearts die uitdaging wat veesiekte in Suidelike Afrika gebied het, aanvaar. Met sy inherente belangstelling in die natuur en biologie het hy gou te staan gekom in die middel van die stryd teen runderpes, perdesiekte en bloutong wat toentertyd in raaisels gehul was en onberekenbare ekonomiese verliese veroorsaak het. Weens sy bekwaamheid is hy gou ook betrek by die bestryding van menslike siektes soos pokkies.

Biologie was in die dae van Sir Arnold Theiler 'n beskrywende wetenskap soos duidelik blyk uit die talle nuwe parasiete wat toentertyd beskrywe is. Hy het geleef in die dae voor spesialisasie in veeartsenykunde toe die veld vir navorsing nog totaal braak gelê het. Geen wonder dus dat hy aan sy veelsydigheid kon uiting gee deur te beweeg op die gebied van virologie, protosoölogie, bakteriologie, helmintologie en patologie.

Theiler het egter ook geleef in 'n tydperk van vinnige uitbreiding van kennis en sal weens sy bydraes altyd gereken word as behorende aan die garde van manne soos Pasteur, Koch, Lister, Laveran en Bruce wat 'n revolusie teweeggebring het in die opvattings oor die besmetlike aard van siektes.

Onderstepoort sal altyd bly bestaan as nagedagtenis aan Theiler as die vader van veeartsenykundige navorsing en opleiding in Suid-Afrika.

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But already during the last years of Theiler's life a revolution in biological research was started, the extent and significance of which could not have occurred to Theiler or any of his contemporaries. This revolution was fueled by a continuous series of advances and has been progressively gaining momentum to this very day. It has reached the stage where scientists can understand many disease processes at the molecular level.

The revolution started with the discovery of transformation in pneumococci by Griffith in 1928. He converted strains of non-virulent pneumococcus bacteria into capsulated virulent strains by exposing them to virulent cells that had been killed by high temperature. In the early 1930's the protein nature of all enzymes became universally accepted and in the early 1950's Frederick Sanger worked out the exact sequence of amino acids of the enzyme insulin.

Slowly the one-gene-one-protein concept emerged with important support from studies on sickle-cell anaemia by the chemist Linus Pauling. But everybody realised that the one-gene-one-protein idea, important as it was, could provide no clue to the molecular mechanisms involved in the cell so long as the nature of the gene itself remained a total mystery.

Through a series of advances, DNA which appeared to locate exclusively in the nucleus, and RNA, which was found in the nucleus and cytoplasm, were discovered. But the problem remained to decide whether the gene was made of DNA, proteins or RNA. The first hint that the essential genetic material could be transmitted from one organism to the next came from the abovementioned observation by Griffith. But Avery, McCarty and Macleod finally identified the active transforming fraction as DNA.

Stepwise progress was made in various laboratories using sophisticated techniques such as X-ray crystallography to determine the spatial arrangement of the atoms within compounds. This culminated in 1953 when James Watson and Francis Crick showed that the

DNA molecule is a double helix in which two polynucleotide chains running in opposite directions are held together by hydrogen bonds between pairs of centrally located bases.

The basic features of the double helix were simple and told how DNA stores genetic information which resides in the linear sequence of the 4 bases. They also suggested a chemical mechanism for the self-replication of DNA. From this moment on, the way in which geneticists investigated the gene entered a completely new phase and fundamental discoveries followed in rapid succession.

The transcription of RNA upon DNA templates and the role of the various types of RNA in protein synthesis were elucidated. It was shown that the genetic code is largely, if not entirely universal in all living beings and plants. The replication of even the smallest of viruses is a very complicated affair, achieved only with the aid of highly evolved genetic regulatory systems designed to see that the right molecules are synthesized at just the right time in the life cycle of the virus.

Biochemists could now combine their expertise with that of geneticists and concentrate on proteins that function as enzymes, catalyzing the several thousand biochemical reactions that in the aggregate constitute the metabolism of living cells.

The identification of reverse transcriptase in 1970 and the discovery of DNA restriction enzymes in 1968 and their subsequent application constitute the cornerstone of the all-important recombinant DNA technology of the present day. DNA can be cut apart, modified and reassembled, it can be amplified to many copies. With DNA one can generate RNA and then protein molecules of predetermined size and constitution. Vaccines now being designed with the use of recombinant DNA technology will have a great impact on animal disease control in the future. During the 1970's it was demonstrated that proteins isolated from the surfaces of viruses and some bacteria could induce the production of neutralizing antibody and protect animals against challenge with homologous agents e.g. short segments cleaved from the surface proteins of the foot-and-mouth disease virus served as effective immunogens. It is pleasing to know that Onderstepoort has made considerable advances in this field by identifying the polypeptide fraction responsible for the serotype specificity of the bluetongue virus. The gene encoding for this fraction has also been identified. These sophisticated laboratory procedures are also applied to the study of various other pathogens e.g. the retrovirus of 'jaagsiekte' and *Babesia* parasites.

The production of proteins by molecular cloning has developed since 1973. Cloning, more than any other single factor, has changed the face of biology. It consists of splicing a segment of DNA representing a gene encoding for the desired protein into a bacterial plasmid or viral DNA and subsequently transferring it to a single-celled host for replication of the guest gene and its expression as protein. Cloned protein vaccines have several advantages over whole-agent vaccines. They are non-infectious and stable to temperature variation.

Thus biology in 1986 is dramatically different from its antecedents only 10 years ago. New investigative techniques have made commonplace many experiments that were previously far beyond the reach of even the cleverest experimental biologist. The new molecular biology has done much more than expand the repertoire of laboratory techniques. It has with remarkable rapidity, established a biotechnology industry. Molecular biology has changed the ways people think about living things because they have come to understand the fundamental aspects of life processes. Investigators nowadays think about biological systems in terms of their molecular components and they have come to manipulate molecules. Biologists have become biochemists. They now possess the highly sophisticated electron microscopic, biochemical and genetic engineering procedures to let them tackle the cell's almost overwhelming complexity. Even children at school are familiar with the double helix of DNA as the symbol of the biological revolution that began earlier during this century.

Sir Arnold Theiler, due to the period during which he lived, could not contribute to the revolution in biological research. But his ideal of service, consciousness of endeavour, his pride in a task, his confidence of success in the face of difficulties will always serve as a stimulus to the scientists at Onderstepoort who cannot avoid applying the most advanced modern techniques.

Sir Arnold Theiler het in 1920 die veeartsenykundige fakulteit te Onderstepoort gestig. Hy het navorsing ten volle geïntegreer met opleiding en as leermeester van sy hoogste prestasies bereik. Die klem van veeartsenykundige opleiding het geval op tropiese siektes en parasitologie met die gevolg dat die graduandi goed toegerus was om die heersende probleme die hoof te bied en betrokke te raak by betekenisvolle navorsing. Maar met die jare het veeartsenykunde in verskillende rigtings ontwikkel en het die behoeftes van opleiding dienooreenkomstig verander. Van veeartse word nou verwag om te voorsien in die behoeftes van troeteldiere, 'n hoogs gespesialiseerde melkbeesbedryf, voedselhigiëne, die pluimveebedryf, die farmaseutiese bedryf en nog verskeie ander rigtings. Deur die breë basiese opleiding in die voorgraadse kursus en aangevul deur gespesialiseerde nagraadse opleiding word graduandi gelewer wat meeste van die vertakkings van die veeartsenykunde goed kan behartig. Maar of ons veeartsenykundiges voorsien met 'n genoegsame basis in biochemie om met vertroue sekere navorsingsrigtings te betree is hoogs twyfelagtig. Dit stem tot kommer want as ons nie nou navorsing doen op die mees gevorderde wyse nie, sal ons gou nie meer oplossings hê vir ons mees brandende probleme nie. Die min veeartse wat navorsing as 'n permanente roeping kies, beskou ek as 'n probleem wat dringende aandag vereis van beide opleidingsinrigtings en die persone in beheer van navorsing.